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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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# Office Action Summary

## Application No.

10/589,962

## Applicant(s)

NAGASAKA, HIROYUKI

## Examiner

Christina Riddle

## Art Unit

2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 6/11/2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1, 3-12, 14-23, 26-30 and 40-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3-12, 14-23, 26-30, 40-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 8/18/2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Status*

1. Acknowledgment is made of the amendment filed on 6/11/2010 which amended claims 1, 3-6, 12, 14-17, 19, 22, 27, and 30, cancelled claims 24-25, 31, and 33-39 and added new claims 40-42. Claims 1, 3-12, 14-23, 26-30, and 40-42 are currently pending.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 9, 11, 12, 22, 26, 27, 30, and 40-42 are rejected under 35 U.S.C. 102(b) as being anticipated by Ozawa et al. (US Patent No. 5,739,898, Ozawa hereinafter).

**Regarding claim 1**, Ozawa discloses an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times) wherein

a substantial wavelength of an exposure light in a space between a projection optical system, which projects said exposure light on said photosensitive object, and said photosensitive object is different in at least one exposure in said plurality of times

of exposure from another exposure (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, the exposure wavelength of the exposure apparatus is controlled by the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), and

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure, and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths), and

wherein said exposure method is performed using a single exposure apparatus and said same photosensitive object is exposed with one illumination area, between said projection optical system and said photosensitive object, for said at least one exposure and said another exposure of said plurality of times of exposure (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths).

**Regarding claim 9**, Ozawa discloses wherein a wavelength of exposure light made to enter said projection optical system in said at least one exposure is different from a wavelength of exposure light in said another exposure (Fig. 37 and col. 39, line

55-col. 40, line 10, interference filter 3021 selects a first or second wavelength that is made to enter projection optical system 3019).

**Regarding claim 11**, Ozawa discloses a device manufacturing method including a lithography process (col. 1, lines 10-14, semiconductor devices are produced using a lithography process) wherein

the exposure method of claim 1 is performed to expose a photosensitive object a plurality of times (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths).

**Regarding claim 12**, Ozawa discloses an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times), said method comprising:

exposing, under a first exposure condition where a substantial wavelength of an exposure light in a space between an optical member and said photosensitive object is a first wavelength, said photosensitive object by said exposure light of said first wavelength (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to the first wavelength); and

exposing, under a second exposure condition where a substantial wavelength of said exposure light in a space between said optical member and said photosensitive object is a second wavelength different from said first wavelength, said photosensitive

object by said exposure light of said second wavelength (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to the second wavelength), wherein

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure, and after said plurality of areas are exposed by one of the exposure under said first exposure condition and the exposure under said second exposure condition, said plurality of areas are exposed by the other of the exposure under said first exposure condition and the exposure under said second exposure condition (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths), and

said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a same exposure apparatus with one illumination area between said optical member and said photosensitive object (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths).

**Regarding claim 22**, Ozawa discloses wherein a wavelength of exposure light made to enter said optical member in said exposure under said first exposure condition is different from the wavelength of exposure light in said exposure under said second exposure condition (Fig. 37 and col. 39, line 55-col. 40, line 10, interference filter 3021

selects a first or second wavelength that is made to enter projection optical system 3019).

**Regarding claim 26**, Ozawa discloses a device manufacturing method including a lithography process (col. 1, lines 10-14, semiconductor devices are produced using a lithography process) wherein

the exposure method of claim 12 is performed to expose a photosensitive object a plurality of times (Fig. 37, col. 38, lines 35-65, col. 39, line 55-col. 40, line 41, the patterns on the reticle are transferred to all areas on the wafer to multiply expose the entire wafer using different wavelengths).

**Regarding claim 27**, Ozawa discloses an exposure apparatus (Figs. 11, 25, and 37) that performs a plurality of times of exposure on a same photosensitive object (Figs. 11, 25, and 37 and col. 38, lines 35-65, wafer W is exposed multiple times), said apparatus comprising:

a stage that holds said photosensitive object (Fig. 11, movable stage 230 supports wafer 190 or Fig. 25, wafer stage WST supports wafer W);

a projection optical system that projects an exposure light on said photosensitive object (Fig. 37, projection optical system 3019 projects light from photomask 3018 onto wafer 3020);

an adjustment unit (interference filter 3012, Fig. 37) that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, interference filter 3012 selects the exposure wavelength of light so that the

wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted); and

a control unit (Figs. 25 and 37 and col. 39, line 55-col. 40, line 21, a main control system 1023) that controls said adjustment unit when exposing said photosensitive object a plurality of times so that in at least one exposure of said plurality of times, said substantial wavelength of said exposure light in said space is different from the substantial wavelength in another exposure (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures),

wherein the exposure apparatus is a single exposure apparatus and said same photosensitive object is exposed with one illumination area, between said projection optical system and said same photosensitive object, for said at least one exposure and said another exposure (Figs. 11, 25, and 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths).

**Regarding claim 30,** Ozawa discloses a device manufacturing method including a lithography process (col. 1, lines 10-14, semiconductor devices are produced using a lithography process) comprising



transferring a device pattern onto a photosensitive object by using the exposure apparatus according to Claim 27 (Figs. 25 and 37, a pattern on a reticle 3018 is transferred onto wafer 3020), and

performing further lithography processing (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10 and col. 60, lines 8-19, the wafer is multiple exposed to a pattern on a reticle by controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures and further processing is performed to form a semiconductor device).

**Regarding claims 40-42,** Ozawa discloses wherein throughout said plurality of times of exposure, said photosensitive object is exposed with said one illumination area (Fig. 37, col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths using one projection optical system 3019).

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 3, 6-8, 14, and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa as applied to claims 1 and 12 above, and further in view of

Fujishima et al. (JP2000-058436, Fujishima hereinafter; included with Applicant's IDS submitted 2/13/2009).

**Regarding claim 3**, Ozawa does not appear to explicitly describe wherein in said at least one exposure, said space is in a state filled with a predetermined liquid.

However, Fujishima discloses wherein in said at least one exposure, said space is in a state filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

**Regarding claim 6**, Ozawa as modified by Fujishima discloses wherein in said another exposure, said space is in a state not filled with liquid (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus and Fujishima, Fig. 1, and para. [0007], wafer 4 is exposed in a normal, dry exposure method).

**Regarding claim 7**, Ozawa as modified by Fujishima discloses wherein said at least one exposure is performed prior to said another exposure (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred).

**Regarding claim 8**, Ozawa as modified by Fujishima discloses wherein said at least one exposure is performed after said another exposure is performed (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred).

**Regarding claim 14**, Ozawa does not appear to explicitly describe wherein said exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid.

However, Fujishima discloses wherein said exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa with structures in

the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical aperture of the lithography system (para. [0002]).

**Regarding claim 19**, Ozawa as modified by Fujishima discloses wherein in said another exposure under said second exposure condition is a dry exposure performed in a state where said space is not filled with liquid (Ozawa, Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus and Fujishima, Fig. 1, and para. [0007], wafer 4 is exposed in a normal, dry exposure method).

**Regarding claim 20**, Ozawa as modified by Fujishima discloses wherein said exposure under said first exposure condition is performed prior to said exposure under said second condition (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred and as modified by Fujishima, the first exposure is performed under a liquid immersion condition, Fig. 1 and para. [0008]).

**Regarding claim 21**, Ozawa as modified by Fujishima discloses wherein said exposure under said first condition is performed after said exposure under said second exposure condition has been performed (Ozawa, Fig. 37 and col. 38, lines 35-65, and col. 39, line 55-col. 40, line 21, multiple exposure is performed so that the exposure wavelength of light between the projection optical system 3019 and wafer 3020 is adjusted to either the first or second wavelength depending on which exposure is occurring and has occurred and as modified by Fujishima, the first exposure is performed under a liquid immersion condition, Fig. 1 and para. [0008]).

6. Claims 4, 5 and 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa as modified by Fujishima as applied to claims 3 and 14 above, and further in view of Kudo (JP 10-340846, included in Applicant's IDS filed 11/30/2006).

**Regarding claim 4**, although Ozawa discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said another exposure, said space is in a state filled with another liquid that has a refractive index smaller than a refractive index of said predetermined liquid.

Kudo discloses said space is in a state filled with another liquid that has a refractive index smaller than a refractive index of said predetermined liquid ([0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as taught by Kudo in the multiple exposure method taught by Ozawa as modified by Fujishima since an immersion fluid with different refractivity is commonly used to allow improved control of numerical aperture for different process conditions, thereby allowing better control of imaging performance.

**Regarding claim 5**, although Ozawa discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein in said another exposure, said space is in a state filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object lower than said predetermined liquid.

However, Kudo discloses wherein said space is filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object lower than said predetermined liquid (paragraph labeled [A 2<sup>nd</sup> embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an

additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the multiple exposure method taught by Ozawa as modified by Fujishima since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

**Regarding claim 15,** Ozawa discloses performing multiple exposure (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein said exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has a refractive index different from a refractive index of said predetermined liquid.

However, Kudo discloses wherein said space is filled with another liquid that has a refractive index different from a refractive index of said predetermined liquid (paragraph [0030], a liquid additive of a different type, and thus a different refractive

index, fills the space, and [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a different index of refraction than another liquid as taught by Kudo in the multiple exposure method taught by Ozawa as modified by Fujishima since an immersion fluid with different controllable refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

**Regarding claim 16**, Ozawa as modified by Fujishima in view of Kudo discloses wherein said predetermined liquid has a refractive index larger than the refractive index of said another liquid (Kudo, [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

**Regarding claim 17**, Ozawa discloses multiple exposure of a substrate (Figs. 25 and 37 and col. 29, lines 6-8, col. 38, lines 35-65, and col. 39, line 55-col. 40, line 10, main control system 1023 of an exposure apparatus controls operations of the entire apparatus, including controlling the interference filter 3012 to control the exposure wavelength so that the exposure wavelength is different for each exposure during the multiple exposures), Ozawa as modified by Fujishima does not appear to explicitly describe wherein said exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has a solubility to a specific material contained within a photosensitive agent of said photosensitive object different from said predetermined liquid.



However, Kudo discloses wherein said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid that has solubility to a specific material contained within a photosensitive agent of said photosensitive object different and smaller than said predetermined liquid (paragraph labeled [A 2<sup>nd</sup> embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as taught by Kudo, in the multiple exposure method taught by Ozawa as modified by Fujishima since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

**Regarding claim 18,** Ozawa as modified by Fujishima in view of Kudo discloses wherein said another liquid has solubility to said specific material contained within said photosensitive agent of said photosensitive object smaller than said predetermined liquid (Kudo, paragraph labeled [A 2<sup>nd</sup> embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

7. Claims 10 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa.

**Regarding claims 10 and 23**, the first embodiment of Ozawa does not appear to explicitly describe wherein in said at least one exposure, a phase shift method is used.

However, Ozawa discloses wherein in said at least one exposure, a phase shift method is used (col. 12, lines 23-28, col. 13, lines 52-61, and col. 46, lines 57-col. 47, line 10, a phase shift mask is used to improve contrast and resolution).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment taught by Ozawa in the exposure apparatus changing the exposure wavelength taught by Ozawa since, as shown by Ozawa, a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution and contrast (col. 12, lines 23-28).

8. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa as applied to claim 27 above, and further in view of Kudo (JP 10-340846, included in Applicant's IDS filed 11/30/2006) in view of Fujishima.

**Regarding claim 28**, although Ozawa discloses in another exposure, no liquid is supplied to said space (Fig. 37 and col. 39, line 55-col. 40, line 10, a single exposure apparatus projects light between projection optical system 3019 and wafer 3020 to multiply expose the wafer with different wavelengths in a dry apparatus), Ozawa does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies a predetermined liquid so that in a space between said

projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid, whereby said control unit controls adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure.

However, Kudo discloses said adjustment unit comprises a liquid supply mechanism (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS and LQ and valves DVLS, DVLWS, and DVL, supply a predetermined liquid to the space) that supplies a predetermined liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space),

whereby said control unit (Fig. 3 and para. [0031], control unit CPU 2) controls said adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid supply mechanism that supplies a liquid to the space and a control unit that controls the adjustment unit to control the liquid supply mechanism as taught by Kudo in the exposure apparatus taught by Ozawa since supplying a liquid with a wavelength adjustment and control unit in an exposure apparatus is commonly used in the art to improve pattern resolution and to increase the numerical aperture to the exposure apparatus in order to pattern smaller feature sizes.

However, Ozawa as modified by Kudo does not appear to explicitly describe wherein in said one exposure the liquid supply mechanism supplies liquid to the space whereas in said another exposure said liquid supply mechanism does not supply said liquid to said space.

However, Fujishima discloses wherein in said one exposure the liquid supply mechanism does not supply liquid to said space (Fig. 1, paras. [0007] and [0008], wafer 5 can be exposed under a dry exposure or with a liquid in the space between the projection optical system 2 and wafer 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the exposure apparatus taught by Ozawa as modified by Kudo with structures in the exposure apparatus as taught by Fujishima in order to allow one of the multiple exposures as taught by Ozawa as modified by Kudo to be an immersion exposure as taught by Fujishima since, as shown by Fujishima, a space is in a state filled with a predetermined liquid in an exposure is common in order to improve pattern resolution and to achieve smaller printed patterns due to changing the numerical

aperture of the lithography system (para. [0002]) and since performing one exposure in a state in which the space between the projection system and the object to be exposed is not filled with liquid is commonly known in the art to be a faster method of exposure than immersion exposure, thereby improving throughput in multiple exposure techniques by including an apparatus that is capable of both immersion and dry exposure.

9. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozawa as applied to claim 27 above, and further in view of Kudo (JP 10-340846, included in Applicant's IDS filed 11/30/2006).

**Regarding claim 29**, Ozawa does not appear to explicitly describe wherein said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid, whereby

said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space.

However, Kudo discloses said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space

between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space (Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction by changing the supply of the additive and thereby, changing the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include a liquid supply mechanism that supplies a plurality of types of liquid to the space as taught by Kudo in the exposure apparatus taught by Ozawa since supplying a variety of liquids in a wavelength adjustment and control unit is commonly used in the art to correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation, while ensuring that the liquids used in the immersion space do not adversely effect imaging due to interaction with the surface of the photosensitive film on the object to be exposed.

***Response to Arguments***

10. Applicant's arguments, see pages 9-10, filed 6/11/2010, with respect to the rejections of claims 11 and 26 under 112, second paragraph have been fully considered and are persuasive. The 112, second paragraph rejection of claims 11 and 26 has been withdrawn.
11. Applicant's arguments, see page 10, filed 6/11/2010, with respect to the rejections of claim 30 under 112, second paragraph and 101 have been fully considered and are persuasive in light of the amendment to claim 30. The 112, second paragraph and 101 rejections of claim 30 have been withdrawn.
12. Applicant's arguments with respect to claims 1, 3-12, 14-23, 26-30 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kanai et al. (US Patent No. 6,165,692) discloses exposing a wafer with multiple wavelengths in multiple exposures.

Kawashima et al. (US Patent No. 6,351,304) discloses multiple exposures of a wafer using different wavelengths.

Nolscher et al. (US PGPub 2006/0244937) discloses performing more than one exposure with different wavelengths.

Wegmann et al. (US PGPub 2008/0036982) discloses multiple exposures with different illumination settings including changing the wavelength of the radiation.

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Riddle whose telephone number is (571)270-7538. The examiner can normally be reached on Monday- Thursday 7:00-17:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571)272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Peter B. Kim/  
Primary Examiner, Art Unit 2882

/C. R./  
Examiner, Art Unit 2882